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Middle Susquehanna River Subbasin Small Watershed Study: Wyalusing Creek Watershed

A Water Quality and Biological Assessment, October 2002 - September 2003

SUSQUEHANNA RIVER BASIN COMMISSION

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The Susquehanna River Basin Commission (SRBC) conducted a survey in the Wyalusing Creek Watershed from October 2002 to September 2003 as part of the Year-2 small watershed study in the Middle Susquehanna Subbasin. The Year-1 survey was conducted in the Middle Susquehanna Subbasin from July to September 2001 (LeFevre, 2002). Based on findings from the Year-1 survey and input from local interests, SRBC decided to conduct its in-depth Year-2 study in a watershed with a newly forming watershed group, in order to provide baseline data on stream health and assist in restoration efforts. Also, a Total Maximum Daily Load (TMDL) was developed recently for a stream in the Wyalusing Creek Watershed as part of Pennsylvania's requirements under the Clean Water Act. The study will assist the Pennsylvania Department of Environmental Protection (PADEP) in determining whether TMDL limits are being met. The Year-2 survey included bimonthly water chemistry samples and flow measurements, and spring sampling and assessment of the macroinvertebrate community and habitat. For more information on the Subbasin Survey Program at SRBC, see reports by Diehl and Sitlinger (2001), LeFevre (2002), and LeFevre (2003). These reports can be accessed via SRBC's web site at http://www.srbc.net/techreports.htm. Previous surveys were performed on the main branch Wyalusing Creek (LeFevre, 2002; Water Quality and Monitoring Programs Division, 1997; and Malione and others, 1984), South Branch Wyalusing Creek (Rider and Blacksmith, 1985), and Pettis Creek (Bureau of Water Quality Management, 1984). A comparison of this historical data and the present assessments of these streams will be addressed in this report.

Description of the Wyalusing Creek Watershed

The Wyalusing Creek Watershed is located in Bradford and Susquehanna Counties in northeastern Pennsylvania and includes significant portions of Bridgewater, Forest Lake, Jessup, Middletown, Rush, Pike, Stevens, Herrick, and Wyalusing Townships (Figure 1).

S. LeFevre

North Branch Wyalusing Creek north of Gaylord Creek, Susquehanna County

The watershed drains about a 220-square-mile area from Montrose to Wyalusing, and lies within Ecoregion 60 – Northern Appalachian Plateau and Uplands. This ecoregion is characterized as a transition region from the more urbanized, agricultural, and flatter topography areas of the ecoregions to the north and west to the more mountainous, forested, and less populated ecoregions to the south and east (Omernik, 1987).

Wyalusing Creek Watershed is mostly forested and cultivated land with two urbanized areas, Montrose and Wyalusing Boroughs, located respectively in the headwaters and mouth of Wyalusing Creek (Figure 1). Agricultural fields are mostly hay and grain for cattle feed, and the forests are predominantly oak and northern hardwoods. This watershed is located in a previously glaciated region, and the soils are derived from glacial till.

In 2003, a Wyalusing Creek Watershed group was in the early stages of forming and officially establishing itself. Some of the group's concerns in early 2003 included: excess sedimentation in streams due to quarries, stone-cutting facilities, and lumber activities; erosion of property from streams; health and quality of lakes for recreation; increasing recreation opportunities on the main branch of the Wyalusing; and the condition of bridges and debris jams during high water.

Five permitted discharges currently exist in the watershed. Three public municipal wastewater permits include discharges into Pettis, Rockwell, and Cold Creeks. One nonpublic wastewater discharge enters Wyalusing Creek near Camptown, and one industrial waste discharge enters Wyalusing Creek upstream of the confluence of Brewer and Wyalusing Creeks.

A Superfund National Priorities List (NPL) site exists in the Wyalusing Creek Watershed near South Montrose in Bridgewater Township, Susquehanna County in the headwaters of South Branch Wyalusing Creek. Hazardous waste from aircraft manufacturing was disposed on the property of Bendix Flight Systems Division from 1952 to 1978 (USEPA, 2004a). The site was placed on the NPL in 1987, and construction of remedial activities was completed in 1996 and upgraded in 2000 (USEPA, 2004a). The site is regularly monitored for surface water and groundwater contamination, and contaminated groundwater is continually pumped and treated (USEPA, 2004a).

South Branch Wyalusing Creek also was listed on the 1996 and 1998 303(d) List of impaired waters, and PADEP completed a TMDL for nutrients and sediment in 2001 (PADEP, 2001). Three miles of the stream were listed as impaired in 1996, and the entire length (5.74 miles) was listed as impaired in 1998. The source for the listing of this stream was an SRBC publication (McMorran, 1987); however, the original survey was performed by the Pennsylvania Department of Environmental Resources Bureau of Water Quality Management (Rider and Blacksmith, 1985). This assessment identified impairments associated with nutrients and poor habitat from inadequately treated sewage, agricultural runoff, low base flow, and detrimental agricultural practices surrounding the stream. These problems were located mostly in the headwaters of the stream. Good water quality and macroinvertebrate populations were found at the lower stations, despite some continued habitat problems. Due to these habitat impairments, the small size of the stream, and the presence of warm water fishes, the surveyors determined that the South Branch Wyalusing Creek was not meeting its designated use for Cold Water Fishes, and recommended that it be designated as Warm Water Fishes (Rider and Blacksmith, 1985). The stream designation was changed, and South Branch Wyalusing Creek is presently classified as Warm Water Fishes (The Commonwealth of Pennsylvania, 2002).

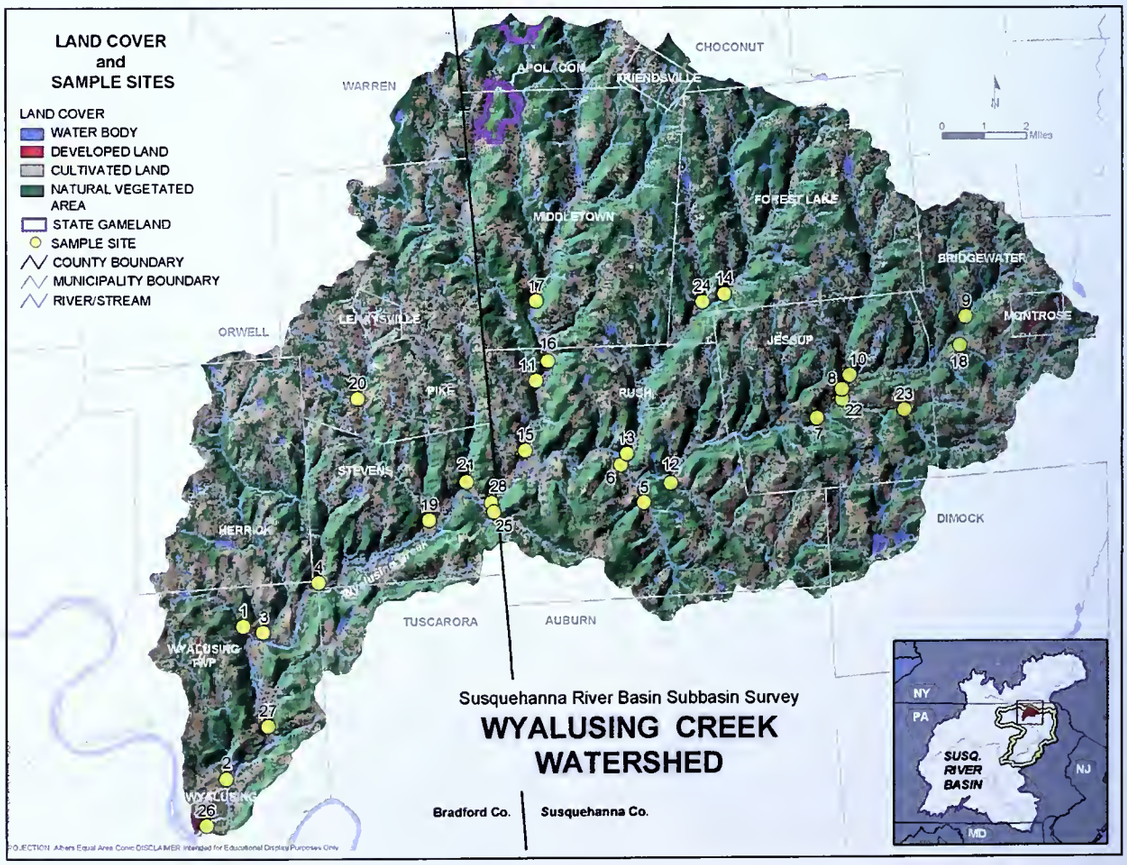

Figure 1.
Land Use and Township Boundaries in the Wyalusing Creek Watershed

Inset shows the Wyalusing Creek Watershed area within the Middle Susquehanna Subbasin and the larger Susquehanna River Basin.

D. Gavlin/J. Zimmerman

Methods

DATA COLLECTION

During October 2002 to September 2003, SRBC collected water chemistry and macroinvertebrate samples, and assessed habitat at 28 sites throughout the Wyalusing Creek Watershed. Appendix A contains a list of the sample site numbers, the station name (designated by stream mile), a sampling location description, latitude and longitude coordinates, and drainage size categories. Water chemistry was collected at all stations bimonthly during the months of November, February, April, May, June, and September. Water quality and flow samples were not collected in February at sites SBWC 0.1, DEER 0.1, EBWC 0.1, GAYL 0.1, ROCK 0.1, CAMP 0.1, and BILL 0.1 due to frozen stream conditions. Macroinvertebrate samples and habitat assessments were completed in May 2003 according to a modified version of the U.S. Environmental Protection Agency's (USEPA's) Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers (RBP III) (Barbour and others, 1999).

Water quality of the streams in the Wyalusing Creek Watershed was analyzed mostly for nutrients and sediment based on the rural character of the watershed and the concerns of the watershed group. A list of the field and laboratory parameters and their units is found in Table 1. Samples were split into a 500-ml bottle for nutrient analysis, a 500-ml bottle for all additional parameters, and a cleaned glass bottle for sediment analysis. All other water quality, macroinvertebrate collection, and habitat assessment methods follow the methods listed in LeFevre (2003).

Table 1. Water Quality Parameters Sampled in the Wyalusing Creek Watershed

FIELD PARAMETERS	
Flow, instantaneous cfs[a]	Conductivity, µmhos/cm[c]
Temperature, °C	Alkalinity, mg/l
pH	Acidity, mg/l
Dissolved Oxygen, mg/l[b]	
LABORATORY ANALYSIS	
Total Suspended Solids, mg/l	Total Phosphorus, mg/l
Total Nitrogen, mg/l	Total Orthophosphate, mg/l
Total Ammonia - N, mg/l	Total Organic Carbon, mg/l
Total Nitrite - N, mg/l	Total Residue, mg/l
Total Nitrate - N, mg/l	Suspended Sediment, ppm[d]

[a] cfs = cubic feet per second
[b] mg/l = milligram per liter
[c] µmhos/cm = micromhos per centimeter
[d] ppm = parts per million

DATA ANALYSIS

Two reference categories were created for data analysis based on drainage size. Small drainage size sites were less than 50 square miles, and medium drainage size sites were between 50 and 500 square miles. Water quality was assessed by comparing the data collected to water chemistry values that were at a level of concern based on current state and federal regulations or references for approximate tolerances of aquatic life (Table 2). Alkalinity was not used in the water quality analysis, due to ubiquitous low alkalinity values in this watershed, suggesting naturally lower alkalinity conditions. The difference between each value and the level of concern value from Table 2 was calculated for each site, and if the value did not exceed the level of concern value, the site was given a score of zero. If the level of concern value was exceeded, the difference was listed, and an average of all the parameters for each site was calculated. The six bimonthly sample averages were combined for a cumulative average. The sites were grouped according to their reference categories, and a percentage of the highest average value (representing the worst water quality) was taken in order to account for differences in water quality between drainage sizes. All sites that received a zero (no parameters exceeded the limits) were classified as "higher" quality. Sites that had a percentage value between zero and one were classified as "middle" quality, and sites that had a percentage value greater than one were classified as "lower" quality.

Table 2. Water Quality Levels of Concern and References

PARAMETERS	LIMITS	REFERENCE CODES
Temperature	>25 °C	a,f
Dissolved Oxygen	<4 mg/l	a,g
Conductivity	>800 µmhos/cm	d
pH	<5	c,f
Alkalinity	<20 mg/l	a,g
Total Suspended Solids	>15 mg/l	h
Nitrogen	>1.0 mg/l	j,k,l
Ammonia	>0.2 mg/l	f
Nitrite	>1.0 mg/l	f
Nitrate	>1.0 mg/l	e
Phosphorus	>0.1 mg/l	e
Total Orthophosphate	>0.05 mg/l	l
Total Organic Carbon	>10 mg/l	b
Residue	>500 mg/l	a,i,m
Sediment	>80 ppm	n

REFERENCE CODES/REFERENCE	
a	http://www.pacode.com/secure/data/025/chapter93/s93.7.html
b	Hem (1970)
c	Gagen and Sharpe (1987) and Baker and Schofield (1982)
d	http://www.uky.edu/WaterResources/Watershed/KRB_AR/wq_standards.htm
e	http://www.uky.edu/WaterResources/Watershed/KRB_AR/krww_parameters.htm
f	http://www.hach.com/h2ou/h2wtrqual.htm
g	http://sites.state.pa.us/PA_Exec/Fish_Boat/education/catalog/pondstream.pdf
h	http://www.deq.state.va.us/pdf/watrregs/fish.pdf
i	http://www.dec.state.ny.us/website/regs/703.htm
j	http://water.usgs.gov/pubs/circ/circ1225/images/table.html
k	http://www.ecan.govt.nz/Land/pdf%20files/sheet13.pdf
l	http://h2osparc.wq.ncsu.edu/info/
m	http://www.epa.gov/safewater/mcl.html#mcls
n	http://www.pac.dfo-mpo.gc.ca/sci/psarc/HSRs/hab1.pdf

Benthic macroinvertebrate samples were analyzed using seven metrics mainly derived from RBP III (Barbour and others, 1999): (1) taxonomic richness; (2) modified Hilsenhoff Biotic Index; (3) percent Ephemeroptera; (4) percent contribution of dominant taxon; (5) number of Ephemeroptera/Plecoptera/Trichoptera (EPT) taxa; (6) percent Chironomidae; and (7) Shannon-Wiener Diversity Index. Reference sites were determined for each reference category, primarily based on the results of the macroinvertebrate metrics and secondarily based on habitat and water quality scores, to represent the best combination of conditions. The metric scores were compared to the reference scores, and a biological condition category was assigned based on RBP III methods (Plafkin and others, 1989; Barbour and others, 1999).

The same reference sites were used in the analysis for the habitat scores. The ratings for each habitat condition were totaled, and a percentage of the reference site was calculated. The percentages were used to assign a habitat condition category to each site (Plafkin and others, 1989; Barbour and others, 1999).

Taxonomic Richness: Total number of taxa in the sample. Number decreases with increasing stress.

Hilsenhoff Biotic Index: A measure of organic pollution tolerance. Index value increases with increasing stress.

Percent Ephemeroptera: Percentage of number of Ephemeroptera in the sample divided by the total number of macroinvertebrates in the sample. Percentage decreases with increasing stress.

Percent Contribution of Dominant Taxa: Percentage of the taxon with the largest number of individuals out of the total number of macroinvertebrates in the sample. Percentage increases with increasing stress.

EPT Index: Total number of Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) taxa present in a sample. Number decreases with increasing stress.

Percent Chironomidae: Percentage of number of Chironomidae individuals out of total number of macroinvertebrates in the sample. Percentage increases with increasing stress.

Shannon-Wiener Diversity Index: A measure of the taxonomic diversity of the community. Index value decreases with increasing stress.

A comparison of the TMDL limits for South Branch Wyalusing Creek was determined by converting the nitrogen, phosphorus, and sediment results from SBWC 0.1 to a mass loading expressed in pounds per year (lb/yr). This was achieved through converting flow from cubic feet per second (cfs) to million gallons per day (MGD) and then using the formula: lb/yr = concentration mg/l * [(8.345lb/MG)/(mg/l)]* flow MGD * 365 days/year. The average values of the five water quality samples for each parameter were compared to the TMDL limits for South Branch Wyalusing Creek.

Results/Discussions

Water quality, biology, and habitat site conditions for each sampling site are depicted by smaller watersheds in Figure 2. Five sites in the watershed achieved the highest overall ratings in water quality, biology, and habitat. Those sites included two sites on the East Branch Wyalusing Creek (EBWC 8.0, EBWC 0.1), and one site each on Cold Creek (COLD 0.1), Deer Lick Creek (DEER 0.1), and Stonestreet Creek (STON 0.1). The site with the worst overall ratings was Pettis Creek (PETT 0.1) with "lower" water quality and severely impaired biology. There were no non-supporting ratings for habitat. Fifteen sites had "lower" ratings for water quality (see Figure 2).

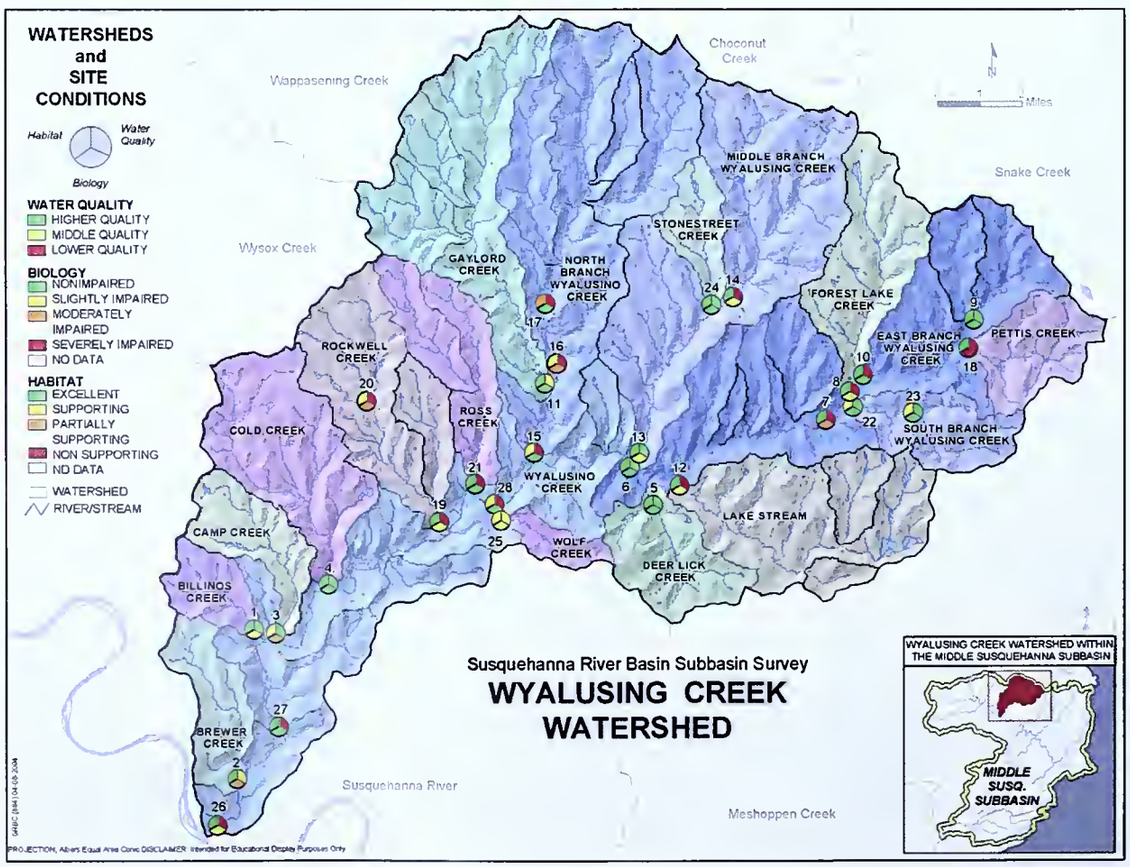

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Figure 2.
Watersheds and Site Conditions in the Wyalusing Creek Watershed

Inset shows the location of the Wyalusing Creek Watershed within the Middle Susquehanna Subbasin.

The "lower" water quality ratings were mostly due to elevated total nitrogen and total nitrate (Table 3). Also, total orthophosphate frequently was higher than the level of concern. The highest overall values for each parameter that exceeded the levels of concern are listed in bold type on Table 3. The highest values of four of the six parameters were found in Pettis Creek samples. The highest values for total suspended solids (TSS) (26 mg/l) were at East Branch Wyalusing Creek (EBWC 5.0) and Lake Stream. The only sample to exceed the level of concern for ammonia was North Branch Wyalusing Creek (NBWC 6.0) with a value of 0.4 mg/l.

EAST BRANCH WYALUSING CREEK

This branch of Wyalusing Creek was nonimpaired in the headwaters, had impaired water quality and biological conditions at the two mid-stream sampling stations, and then recovered at the mouth. The water quality impairments were due to high nitrogen, nitrate, and orthophosphate values, and one high TSS value at EBWC 5.0 (Table 3). The site in the headwaters (EBWC 8.0) had higher taxonomic richness, lower Hilsenhoff Biotic Index score, higher percentage of Ephemeroptera, lower percent dominant taxon, higher number EPT taxa, and higher Shannon-Wiener Diversity Index score than the sites downstream (EBWC 6.0, EBWC 5.0). Habitat was excellent at all of the sites on the East Branch Wyalusing Creek.

Pettis Creek

One of the sources of impairment to East Branch Wyalusing Creek may be Pettis Creek. Pettis Creek is influenced by the Montrose Borough discharge and agricultural land use. SRBC staff noted several areas along Pettis Creek where cattle had access to the stream, which can cause nutrient and pathogen overload and streambank erosion. Every sample that was taken at PETT 0.1 exceeded a level of concern. Also, of all samples in the

Table 3. *Wyalusing Creek Watershed Water Quality Values that Exceeded Levels of Concern*

SITE	DATE	Total Suspended Solids	Total Nitrogen	Total Ammonia	Total Nitrate	Total Phosphorus	Total Orthophosphate	TOTAL EXCEEDANCES
		>15 mg/l	>1.0 mg/l	>0.2 mg/l	>1.0 mg/l	>0.1 mg/l	>0.05 mg/l	
BREW0.1	20030915						0.088	1
EBWC5.0	20021120		1.01					1
EBWC5.0	20030204	**26**	1.38		1.29		0.064	4
EBWC5.0	20030408		1.03					1
EBWC5.0	20030916						0.052	1
EBWC6.0	20030203		1.30		1.23		0.086	3
EBWC6.0	20030625		1.28					1
EBWC6.0	20030916						0.078	1
FOLC0.1	20021119		1.03					1
FOLC0.1	20030623	16						1
FOLC0.1	20030916						0.061	1
GAYL0.1	20021121		1.06					1
LAKE0.1	20021119		1.19					1
LAKE0.1	20030204	**26**	1.33		1.28		0.111	4
LAKE0.1	20030409		1.01					1
MBWC7.0	20030624	18						1
NBWC0.1	20021121		1.27					1
NBWC0.1	20030626		1.39		1.07			2
NBWC5.0	20021121		1.38		1.02			2
NBWC5.0	20030204		1.17		1.14			2
NBWC5.0	20030624		1.30		1.09			2
NBWC6.0	20021126		1.13					1
NBWC6.0	20030204		2.10	**0.40**	1.26		0.084	4
NBWC6.0	20030624		1.20		1.01			2
PETT0.1	20021119		1.69		1.08	0.121	0.090	4
PETT0.1	20030203		**2.90**		**2.64**	0.294	0.297	4
PETT0.1	20030408		1.58		1.22		0.076	3
PETT0.1	20030520		2.47		1.84	**0.386**	**0.313**	4
PETT0.1	20030623					0.119	0.077	2
PETT0.1	20030916		1.68		1.03	0.282	0.246	4
ROCK0.1	20021121		1.16					1
ROCK0.1	20030407		1.04					1
ROCK5.0	20021121		1.29					1
ROCK5.0	20030205		1.24		1.36			2
ROCK5.0	20030407		1.13					1
ROSS0.1	20021121		1.20					1
ROSS0.1	20030205		1.44		1.56			2
WOLF0.1	20030205						0.064	1
WYAL0.1	20021126		1.37		1.35			2
WYAL0.1	20030206		2.04		1.97			2
WYAL0.1	20030522		2.73		2.36		0.080	3
WYAL0.1	20030626		1.76		1.31			2
WYAL0.1	20030918		2.36		2.13	0.104	0.081	4
WYAL10.0	20021121		1.10					1
WYAL10.0	20030205				1.14			1
WYAL10.0	20030626	16						1
WYAL10.0	20030918				2.41			1
WYAL5.0	20030206		1.14					1
TOTAL EXCEEDANCES		**5**	**37**	**1**	**23**	**6**	**17**	

Wyalusing Creek Watershed, the highest values for nitrogen, total nitrate, total phosphorus, and total orthophosphate were obtained at PETT 0.1. This site exhibited the worst water quality of all sites sampled during this time period.

Biology was severely impaired at PETT 0.1 with the lowest taxonomic richness (15), percent Ephemeroptera (2.74 percent), and number of EPT taxa (5) of all the sites in the Wyalusing Creek Watershed. The site was highly dominated by midges (Chironomide) and water penny beetles (*Psephenus*). The habitat was rated excellent at the sampling site although vegetative cover and stream buffer width needed improvement. Algae were very thick and prevalent at this site.

S. LeFevre

Algae in Pettis Creek west of Montrose, Susquehanna County

Pettis Creek was assessed in 1983 as part of a survey to assess its water use designation (Bureau of Water Quality Management, 1984). A comparison of the water quality values during the 1983 survey and the 2002-2003 survey indicates that levels of nutrients and solids have improved. The total nitrogen value in 1983 was approximately 3.35 mg/l (total nitrates + total nitrites + total ammonia), and the total phosphorus value was 0.74 mg/l. Improvements in water quality may be attributable to improvements in the sewage treatment plant at Montrose Borough. The biological conditions in the stream appeared to decline from 1983 to 2003; however, the macroinvertebrate samples were taken in different seasons (September in 1983 and May in 2003), so these results were not directly comparable. A difference in water quality and biology may indicate that habitat has degraded since 1983 or that the water quality was worse at times that were not sampled during this survey.

South Branch Wyalusing Creek

South Branch Wyalusing Creek was originally listed on Pennsylvania's 1996 303(d) List due to impairment from suspended solids and excessive nutrients (PADEP, 2001). The original survey indicated that the impairment was mostly in the headwaters of the stream and was likely due to failing or lack of septic systems, agricultural practices, and the inability of the stream to assimilate these wastes due to its low flow (Rider and Blacksmith, 1985). At farther downstream sites where streamflow increased, some agricultural practices still contributed to poor habitat and increased fecal coliform bacteria; however, the overall water quality and benthic macroinvertebrate populations were adequate and diverse (Rider and Blacksmith, 1985).

The survey by SRBC staff in 2002-2003 indicated that water quality was "higher" quality, and the biology was nonimpaired. There were no values that exceeded levels of concern. In 1984, the total nitrogen and total nitrate values exceeded levels of concern (1.28 mg/l and 1.26 mg/l, respectively) at the headwater site, but not at the lower sites. The habitat was supporting at both sites in 2003 with low values for the riparian vegetative zone, vegetative protective cover, and condition of banks; therefore, some habitat conditions still need improvement. Macroinvertebrate samples from September 1984 and May 2003 were fairly similar to each other with approximately 50 percent of the taxa common to the samples. Differences included slightly more stonefly taxa present in 2003, and the caddisfly family, Hydropsychidae, was much more abundant in 1984.

A comparison of the TMDL limits and the results of this survey indicate that the South Branch Wyalusing Creek is meeting its overall loading limits for nitrogen, phosphorus, and sediment (Table 4). Nitrogen was the only parameter that the average value for 2002 through 2003 was close to exceeding the TMDL.

Table 4. *Comparison of TMDL Limits and Loading Values from 2002-2003 Samples in the South Branch Wyalusing Creek Watershed*

	PADEP (2001)	2002-2003 AVERAGE
POLLUTANT	TMDL (lb/yr)	SBWC 0.1 (lb/yr)
Nitrogen	14,418	13,412
Phosphorus	1,858	475
Sediment	2,480,930	73,548

Other Tributaries to East Branch Wyalusing Creek

Forest Lake Creek and Lake Stream both had "lower" water quality due to elevated nutrients and sediment. Forest Lake Creek slightly exceeded the levels of concern for TSS, total nitrogen, and total orthophosphate. The biology was rated nonimpaired, and the habitat was rated excellent. The sampling site was surrounded by coniferous forest, with good stream cover and mossy banks, and only a small amount of algae was present. Lake Stream was impacted by nutrients and sediment. Total nitrogen at LAKE 0.1 exceeded the level of concern during three of the six months sampled. The February 2003 sample contained the highest TSS value during the survey (26 mg/l), and the values for total nitrate and total orthophosphate also exceeded the levels of concern. The macroinvertebrate population was slightly impaired with lower taxonomic richness, higher percent dominant taxon, lower number of EPT taxa, and lower Shannon-Wiener Diversity Index value. The habitat was rated excellent. Deer Lick Creek had "higher" quality water, nonimpaired biology, and excellent habitat. DEER 0.1 had the highest number of EPT taxa (24) in the survey, and the sampling site was mostly coniferous forest with woody debris and mossy rocks.

MIDDLE BRANCH WYALUSING CREEK

One of the concerns expressed at a Wyalusing Creek Watershed Group meeting was excessive sediment and salt in a tributary to Middle Branch Wyalusing Creek. There is a large stone-cutting operation that discharges wastewater into Stonestreet Creek and an adjacent tributary to the Middle Branch Wyalusing Creek near Turrell Corners. PADEP and USEPA are working with this facility to bring it into compliance and are encouraging use of filters to recycle wastewater and planting of wetland vegetation in settling ponds to aid in sediment removal from the wastewater discharge (Holmes, 2004; PADEP, 2003).

The uppermost sampling site on Middle Branch Wyalusing Creek (MBWC 7.0) had "lower" water quality due to elevated TSS during June 2003. The macroinvertebrate population exhibited slight impairment and was dominated by a stonefly (*Amphinemura*) and Chironomidae. The sampling site was located near a pasture; however, a small vegetated riparian zone existed. Stonestreet Creek at the mouth had "higher" water quality, nonimpaired biology, and excellent habitat. The discharge into Stonestreet Creek from the stone-cutting operation was located in the headwaters above Stonestreet Lake. The sediment and other pollutants may settle out in the lake and, therefore, may not largely impact the stream at the mouth. MBWC 0.1, located at the mouth of Middle Branch Wyalusing Creek, also had a slightly impaired macroinvertebrate community. This site was dominated by Chironomidae and *Psephenus*. The water quality was rated "higher," and the habitat was excellent.

NORTH BRANCH WYALUSING CREEK

Problems on the North Branch Wyalusing Creek were related to water quality and habitat conditions. Water quality was "lower" on all three sites of the North Branch Wyalusing Creek. Total nitrogen and total nitrate were elevated in many of the samples throughout the sampling period. NBWC 6.0 also had the highest ammonia value (0.4 mg/l), and the total orthophosphate value was higher than the level of concern in February. The macroinvertebrate community was nonimpaired at NBWC 6.0 and NBWC 0.1, but was moderately impaired at NBWC 5.0, where Chironomidae dominated the sample.

A landowner indicated concern about an abandoned landfill with municipal and industrial waste that was not contained by the protective liner required in present day landfills. This landfill was located between NBWC 5.0 and NBWC 6.0. Another potential problem for NBWC 5.0 may be a lack of protective streamside vegetation and livestock access to the stream upstream of this site. Eroded banks were noted on this section of stream.

> **"Problems on the North Branch Wyalusing Creek were related to water quality and habitat conditions."**

NBWC 6.0 is the site of a wetland restoration project. Past channelization of the stream and filling of the wetlands created habitat problems in this area. During replacement of the Rt. 858 bridge at this site, the Pennsylvania Department of Transportation restored the wetlands along the stream. The habitat at this site was rated partially supporting due to lack of instream cover, increased sediment deposition, eroded banks, and lack of riffle habitat. The whole stream section was slow and muddy, except at the small riffle where the macroinvertebrate sample was taken. Despite the habitat disturbance at this site, the macroinvertebrate population was nonimpaired. With the mitigation of the wetlands and subsequent protection of the stream, this site has potential to return to a more natural state.

Gaylord Creek, at the mouth, had good quality water with only one instance of total nitrogen value slightly higher than the level of concern. The biology was rated nonimpaired, and the sampling site was protected and shaded by mixed forest.

MAINSTEM WYALUSING CREEK

WYAL 10.0 was located immediately downstream of where the three branches of the creek join to become the mainstem of Wyalusing Creek. This also is the site (referred to as WYL 16.2) of historical sampling from previous Middle Susquehanna Subbasin Surveys (LeFevre, 2002; Water Quality and Monitoring Programs Division, 1997; Malione and others, 1984). In this survey the water quality was "lower" due to slightly high total nitrogen and TSS, and higher total nitrate; however, the macroinvertebrate population was nonimpaired. The habitat was supporting with problems being a low frequency of riffles, frequently moving gravel substrate, lack of diversity in substrate, and some eroded streambanks.

A comparison of the historical data to the current survey data indicates slightly higher nutrient levels in 2003 than historical data. Applying the historical data to the levels of concern used in this report (Table 2) reveals only dissolved oxygen (3.92 mg/l) exceeded levels of concern in 2001 (LeFevre, 2002), no parameters exceeded levels of concern in 1993 (Water Quality and Monitoring Programs Division, 1997), and no parameters exceeded levels of concern in 1982 (Malione and others, 1984). The macroinvertebrate community appeared to remain relatively stable from 1982 to 2003, with no major changes in taxa or quality. The habitat assessment completed in 2001 was very similar to the one com-

pleted in 2003 with scores indicating low frequency of riffles, frequently moving substrate, lack of diversity in substrate, and poor condition of banks. The habitat rating in 1993 was partially supporting; however, the habitat assessment rating method was very different and not comparable. Habitat was not rated in 1982.

Wolf Creek enters Wyalusing Creek just downstream of WYAL 10.0. WOLF 0.1 had "middle" water quality, slightly impaired biology, and supporting habitat. One total orthophosphate value was slightly higher than the level of concern. Taxonomic richness and number of EPT taxa were lower than the other sites in the Wyalusing Creek Watershed; however, this could be due to the smaller size of Wolf Creek. Ross Creek had "lower" quality water at the mouth due to elevated total nitrogen and total nitrate; however, the biology was rated nonimpaired, and the habitat was rated excellent.

Detrimental agricultural practices in the Rockwell Creek Watershed may have caused elevated nutrients and impaired habitat. Total nitrogen was high at ROCK 5.0 in November, February, and April and high at ROCK 0.1 in November and April. Staff could not sample ROCK 0.1 in February due to ice conditions. Chironomidae dominated the moderately impaired macroinvertebrate community at ROCK 5.0, and the sediment in the stream smelled of manure. The habitat was rated supporting due to problems with sediment deposition, poor riparian vegetative zone, and debris from human activities on the banks. This site could be improved with best management practices (BMPs) for agriculture and a more extensive vegetative stream buffer. Habitat conditions and macroinvertebrate community had improved downstream at ROCK 0.1, but the biological conditions rated slightly impaired. The vegetative riparian zone could be wider on the left bank of ROCK 0.1, and problems with embeddedness at this site could be improved by BMPs upstream to reduce sediment load.

Cold, Camp, and Billings Creeks all had "higher" water quality. Cold Creek also had nonimpaired biology and excellent habitat. Camp and Billings Creeks had moderately and slightly impaired biological conditions, respectively. Both CAMP 0.1 and BILL 0.1 were located in the town of Camptown, Pa., and had a low riparian vegetative zone score. CAMP 0.1 also lacked a vegetative protective cover and had concrete slabs in the stream. The moderately impaired macroinvertebrate population may have been due to the habitat or to water quality parameters not tested. The macroinvertebrate population was dominated by pollution-tolerant Chironomidae and had a low number of EPT taxa. The macroinvertebrate population at BILL 0.1 was heavily dominated by *Epeorus*, although this taxon is organic-pollution sensitive.

BREW 0.1 had the highest Hilsenhoff Index Score (indicating numerous pollution-tolerant taxa), low percent Ephemeroptera, highest percent dominant taxa, highest percent Chironomidae, and lowest Shannon-Wiener Diversity Index score. This site was dominated by Chironomidae, which comprised 74 percent of the sample. The habitat was excellent, although the rocks were slippery and white, and there was an odor to the sediment.

Wyalusing Creek at the mouth (WYAL 0.1) had a slightly impaired macroinvertebrate community. The water chemistry had high total nitrogen and total nitrates and exceeded levels of concern for total phosphorus and total orthophosphate. This site also had only one specimen of Trichoptera, higher percent dominant taxon, and lower number EPT than the other medium size drainage sites in the watershed.

S. LeFevre

Brewer Creek northeast of Wyalusing, Bradford County

Wyalusing Creek at Merryall (WYAL 5.0) had the best overall conditions in water quality, biology, and habitat of the three sites on the Wyalusing Creek mainstem. WYAL 5.0 had slightly high total nitrogen during February. Otherwise, this site had nonimpaired biology and excellent habitat. Brewer Creek, which enters Wyalusing Creek between WYAL 5.0 and WYAL 0.1, had higher total orthophosphate than the level of concern and moderately impaired biology. The macroinvertebrate population was one of the most impaired sites in the Wyalusing Creek Watershed. The habitat was rated excellent, and somewhat slippery rocks were noted.

A comparison of historical data to current data indicates improvement in water quality at WYAL 0.1. In the 2001 sample (referred to as WYL 0.4), the dissolved oxygen was near a level of concern (4.12 mg/l), total nitrogen and total nitrate were high (5.5 mg/l and 3.92 mg/l, respectively), total phosphorus was at the level of concern (0.1 mg/l), and total orthophosphate was relatively high (0.077 mg/l). In 1993, total nitrate was very high at 10.1 mg/l (level of concern for human consumption), and total

orthophosphate was 0.049 mg/l. In 1982, the only exceeding value was total phosphorus (0.1 mg/l).

Despite poorer water quality conditions in 1993 and 2001, macroinvertebrate samples were fairly similar in taxonomic composition from 1993 to 2003. Slightly impaired conditions existed in 1993 and 2001, as well as during this survey. No serious habitat impairments existed in 2001, and there was only slight impairment recorded in 1993. The 1982 survey indicated there was not a sewage treatment plant for Wyalusing Borough, and a pool of sewage was noted near the mouth; however, it was located downstream of the sampling site.

Conclusions/ Recommendations

The overall health of streams in the Wyalusing Creek Watershed was good in 2002-2003. Temperature readings ranged from 0 - 21.6 degrees Celsius, pH ranged from 6.0 - 8.0, dissolved oxygen ranged from 5.89 - 13.84 mg/l, and conductivity ranged from 48 - 323 µmhos/cm. Abundant and diverse macroinvertebrate communities inhabited the streams, water pollution was not widespread or severe, and habitat was often natural and provided good cover.

Historical comparisons show possible improvements in water quality at PETT 0.1 and WYAL 0.1; however, macroinvertebrate populations at PETT 0.1 suggest habitat and additional water quality improvements are needed. The biological condition of South Branch Wyalusing Creek indicates the stream is healthy; however, habitat could improve with increased vegetative riparian zone width and vegetative protective cover. Overall, the South Branch Wyalusing Creek appears to be meeting its TMDL limits, although further study is needed to assess the total nitrogen levels in this stream.

Degraded sites such as PETT 0.1, BREW 0.1, LAKE 0.1, NBWC 5.0, ROCK 5.0, CAMP 0.1, and EBWC 5.0 can be remediated. Fencing cattle from streams is good for both the health of the streams and the health of the cattle (Carline, 2004). There are numerous funding programs available (Table 5: B, C, D, H); some of which will pay farmers a rental fee and stipend to help maintain a vegetated stream buffer. For information on stream buffer projects already in the watershed go to: http://www.dep.state.pa.us/WaterManagement_Apps/WatershedManagement/stream/reports.asp or contact the Stream ReLeaf Program at PADEP Bureau of Watershed Management (717-772-5647). BMPs, such as rotational grazing, contour plowing, manure storage, and manure digesters, can also help reduce erosion and high nutrient levels (Table 5: A, B, E, G, H). Best available technology applied to municipal and industrial discharges will improve the health of the stream and may provide savings to industry through recycling of waste products (Table 5: I). Problems from stone-cutting facilities can be mitigated with proper technique and technology. PADEP offers workshops to help stone-cutting businesses in the northeast region (Table 5: F).

Higher quality sites identified in this survey such as EBWC 8.0, DEER 0.1, STON 0.1, EBWC 0.1, and COLD 0.1 should be preserved and protected. New development in this watershed should be responsible and with minimal impact (Table 5: I). Actions taken to reduce stormwater runoff to streams and to recharge the groundwater will result in reduced damaging high flows and subsequent erosion of residents' property. Furthermore, preserving vegetated stream buffers will slow runoff and stabilize banks. New development should be encouraged to be set back from the stream instead of adjacent to the streambank. Also, new bridges should be designed to accommodate high flows to avoid debris dams.

Table 5. *Contact Information for Best Management Practices and Best Available Technology*

REFERENCE CODE	CONTACT	PHONE NUMBER or WEB ADDRESS
A	Bradford Conservation District	(570) 265-5539
B	Bradford County Farm Service Agency	(570) 265-5288 ext. 4
C	Chesapeake Bay Foundation	(717) 234-5550
D	Ducks Unlimited	1-800-45DUCKS
E	Guide to Conservation Funding Programs in Pennsylvania	(717) 234-5550 (Melinda Downey)
F	James Holmes (Northeast Regional Office - PADEP)	(570) 826-5535
G	Susquehanna Conservation District	(570) 278-4600
H	Susquehanna County Farm Service Agency	(570) 278-1011 ext. 4
I	PADEP Office of Energy and Technology Development	http://www.dep.state.pa.us/dep/deputate/pollprev/pollution_prevention.html
	PADEP NORTHCENTRAL REGIONAL OFFICE	(570) 327-0537
	PADEP NORTHEAST REGIONAL OFFICE	(570) 826-2475

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FOR MORE INFORMATION

on a particular stream or more details on the methods used in this survey, contact Susan R. LeFevre, (717) 238-0426 ext. 101, e-mail: slefevre@srbc.net. For additional copies of this subbasin survey, contact the Susquehanna River Basin Commission, 1721 N. Front Street, Harrisburg, PA 17102-2391, (717) 238-0423, fax: (717) 238-2436, e-mail: srbc@srbc.net. For raw data from this survey or more information concerning SRBC, visit our web site: www.srbc.net.

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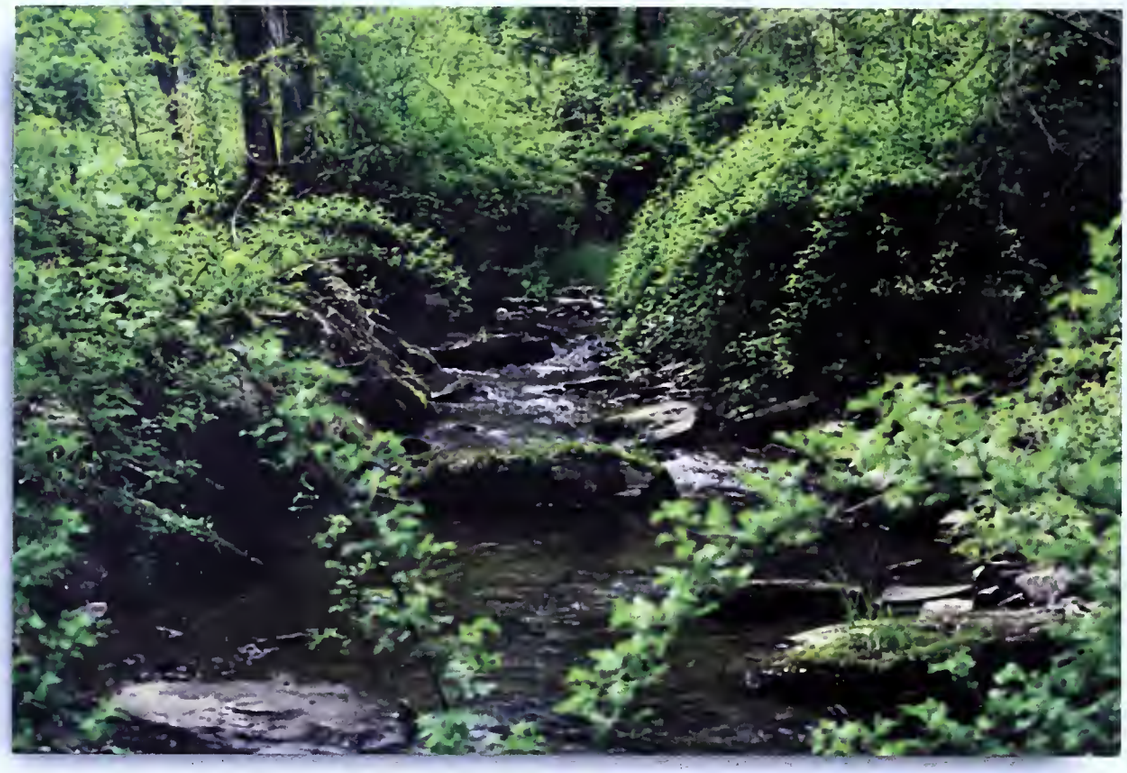
APPENDIX A

Sample Site #	Station	Location Description	Latitude	Longitude	Drainage Size
1	BILL 0.1	Billings Creek upstream of Camptown along Billings Creek Rd.	41.7335	-76.2422	SMALL
2	BREW 0.1	Brewer Creek at T461 bridge (County Bridge Rd.)	41.6813	-76.2515	SMALL
3	CAMP 0.1	Camp Creek upstream of Camptown upstream of T483 (Church Rd.)	41.7316	-76.2333	SMALL
4	COLD 0.1	Cold Creek upstream of Rt. 706	41.7482	-76.2073	SMALL
5	DEER 0.1	Deer Lick Creek along Rt. 267	41.7729	-76.0577	SMALL
6	EBWC 0.1	East Branch Wyalusing Creek upstream of Rt. 367 bridge	41.7858	-76.0681	MEDIUM
7	EBWC 5.0	East Branch Wyalusing Creek upstream of SR3027 bridge	41.8	-75.9777	SMALL
8	EBWC 6.0	East Branch Wyalusing Creek at Fairdale, upstream of Rt. 706 bridge	41.8097	-75.9661	SMALL
9	EBWC 8.0	East Branch Wyalusing Creek upstream of T579 bridge	41.8337	-75.9088	SMALL
10	FOLC 0.1	Forest Lake Creek upstream of SR 3029	41.8144	-75.9625	SMALL
11	GAYL 0.1	Gaylord Creek at mouth, upstream of Rt. 858	41.8154	-76.1062	SMALL
12	LAKE 0.1	Lake Stream upstream of T480 bridge	41.7792	-76.0452	SMALL
13	MBWC 0.1	Middle Branch Wyalusing Creek upstream of T502 bridge	41.7896	-76.0654	SMALL
14	MBWC 7.0	Middle Branch Wyalusing Creek upstream of T480 bridge, upstream of Stonestreet Creek, Birchardsville	41.8433	-76.0189	SMALL
15	NBWC 0.1	North Branch Wyalusing Creek at mouth, along Rt. 858	41.7916	-76.1117	SMALL
16	NBWC 5.0	North Branch Wyalusing Creek upstream of Gaylord Creek, upstream of Rt. 858	41.822	-76.1002	SMALL
17	NBWC 6.0	North Branch Wyalusing Creek upstream of Rt. 858 bridge, upstream of NBWC 5.0	41.8425	-76.105	SMALL
18	PETT 0.1	Pettis Creek upstream of Rt. 706 bridge	41.8239	-75.9116	SMALL
19	ROCK 0.1	Rockwell Creek upstream of Rt. 706	41.7686	-76.1565	SMALL
20	ROCK 5.0	Rockwell Creek at Brushville	41.8105	-76.1877	SMALL
21	ROSS 0.1	Ross Creek upstream of Rt. 706 along SR 1011	41.7815	-76.139	SMALL
22	SBWC 0.1	South Branch Wyalusing Creek at mouth	41.8064	-75.9661	SMALL
23	SBWC 2.0	South Branch Wyalusing Creek upstream of T594 bridge	41.8022	-75.9378	SMALL
24	STON 0.1	Stonestreet Creek upstream Rt. 267 bridge in Birchardsville	41.8408	-76.0289	SMALL
25	WOLF 0.1	Wolf Creek near intersection of T599 (SR 1075) and Schneider Road	41.7707	-76.1267	SMALL
26	WYAL 0.1	Wyalusing Creek at mouth, upstream of Rt. 6 bridge	41.6655	-76.2608	MEDIUM
27	WYAL 5.0	Wyalusing Creek at Merryall (Rt. 706 bridge)	41.6991	-76.2316	MEDIUM
28	WYAL 10.0	Wyalusing Creek upstream of T599/SR1075 (near county line)	41.774	-76.1278	MEDIUM



S. LeFevre

Stonestreet Creek near Birchardsville, Susquehanna County

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In 1972, the Susquehanna River Basin Commission was created as an independent agency by a federal-interstate compact among the states of Maryland, New York, and the Commonwealth of Pennsylvania, and the federal government. In creating the Commission, the Congress and state legislatures formally recognized the water resources of the Susquehanna River Basin as a regional asset vested with local, state, and national interests for which all the parties share responsibility. As the single federal-interstate water resources agency with basinwide authority, the Commission's goal is to coordinate the planning, conservation, management, utilization, development and control of the basin's water resources among the public and private sectors.

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